

Local Monitoring of a Fundamental GPS Site

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I. Motivation

Goal: ITRF with 1 mm accuracy

A new concept of monitoring a fundamental GPS site:

- Monitoring of the local environment to detect linear and non-linear movements



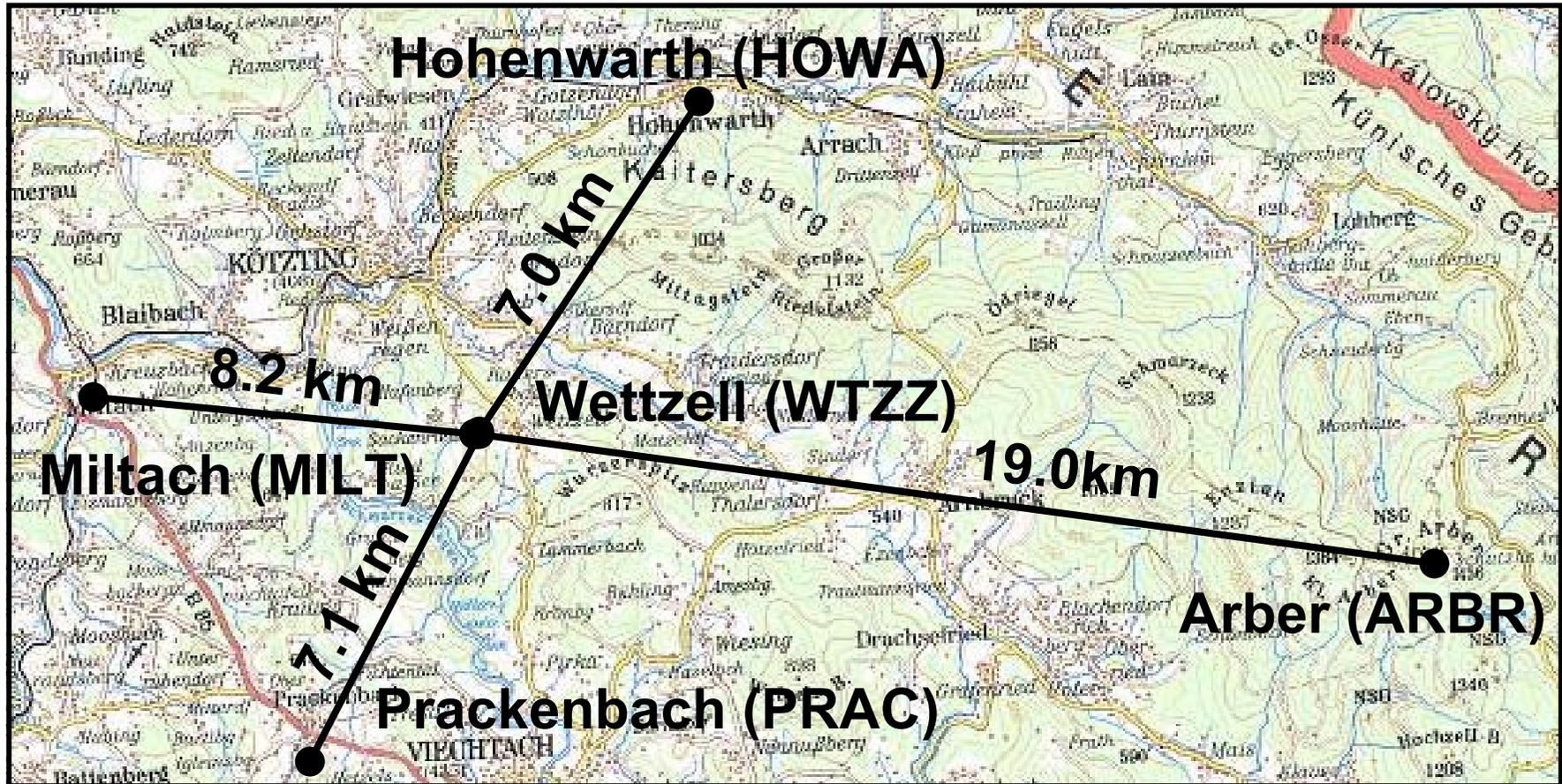
Footprint Network

- Receiver/antenna performance
- Influences of the environment on antennas
- Equipment changes



Antenna Array

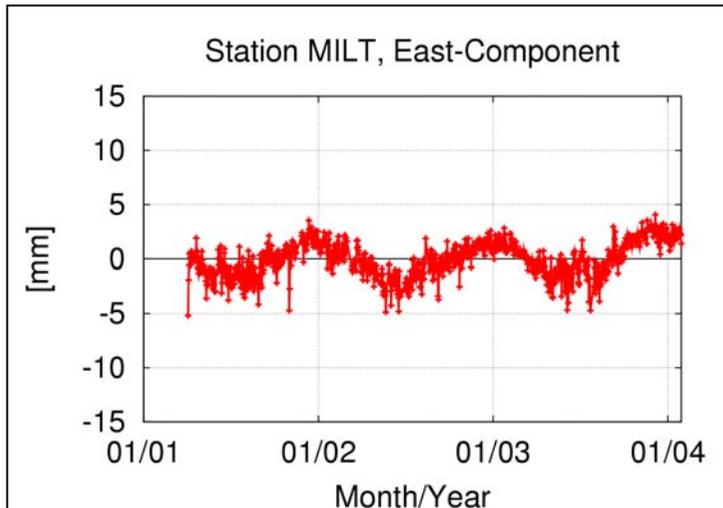
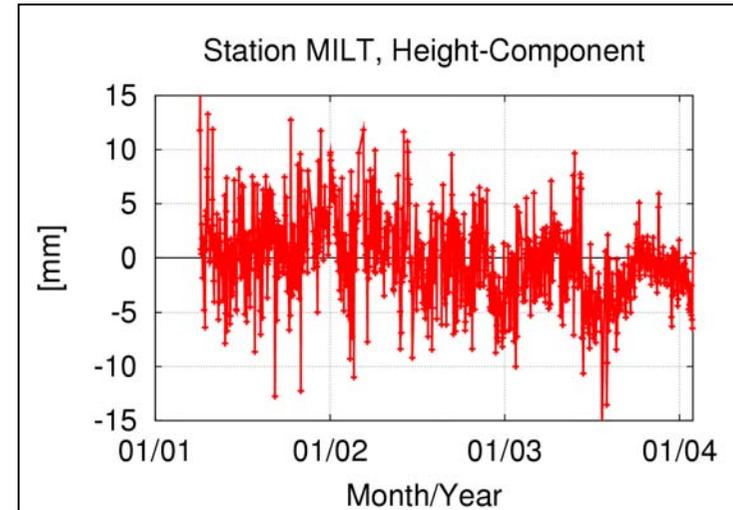
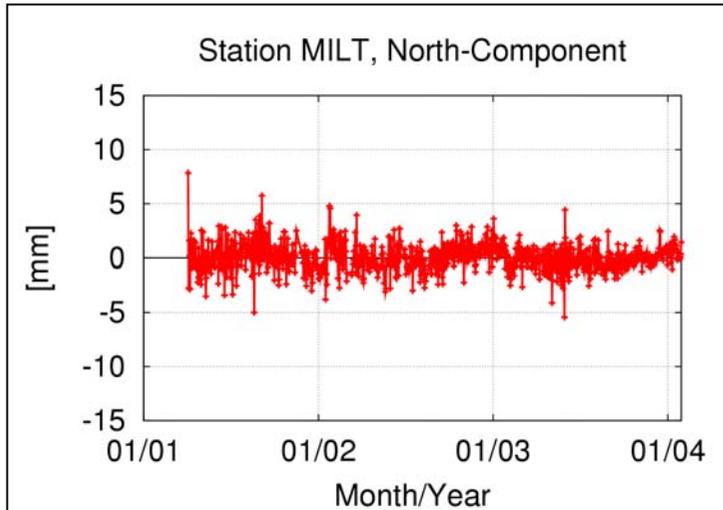
II. Footprint Network: Map and Description



Observation period: Jan. 2001-Jan. 2004, ~ 3 years

Strategy: ionosphere-free ambiguity-fixed solution
(WTZZ as reference)

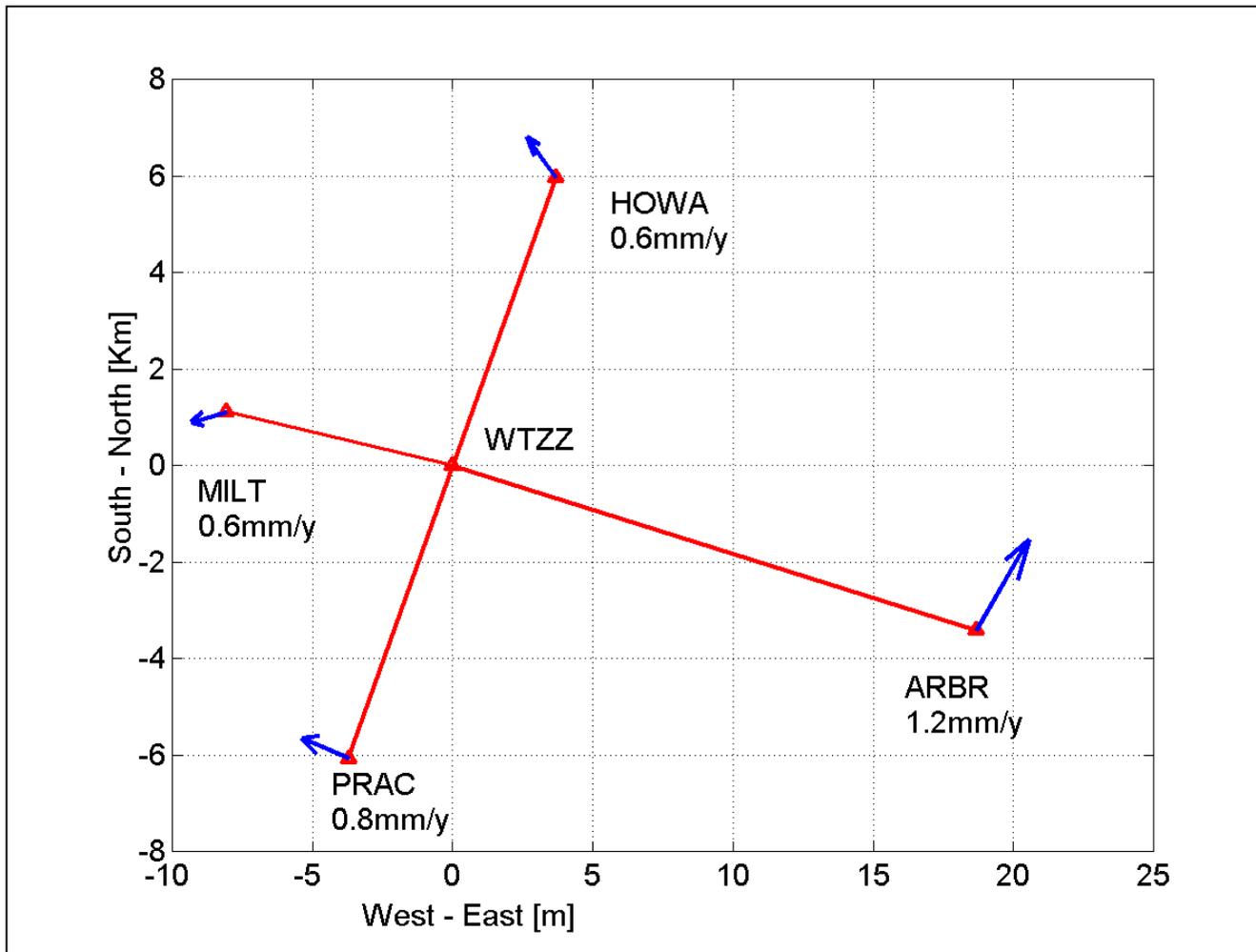
II. Footprint Network: Long-Term Repeatabilities



Repeatabilities of all stations:

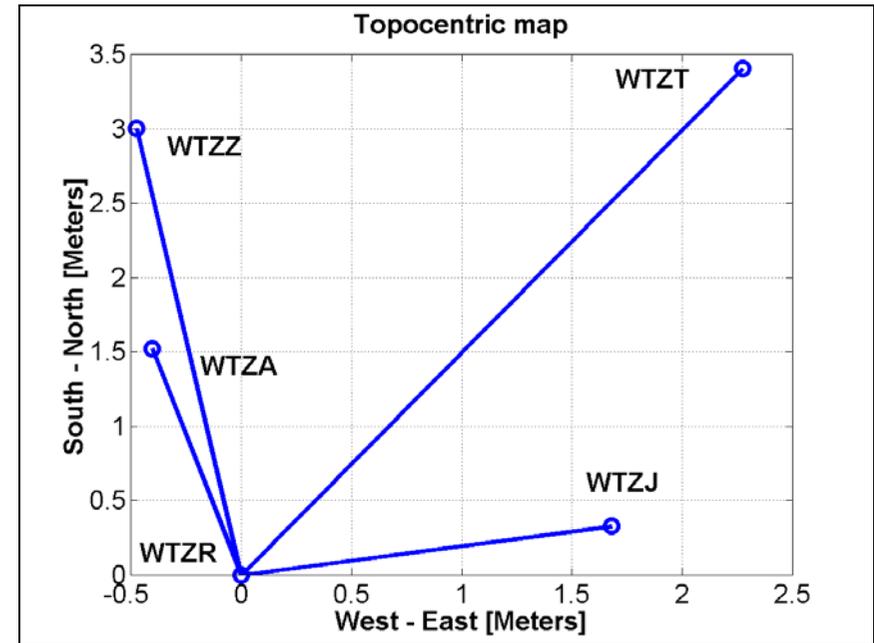
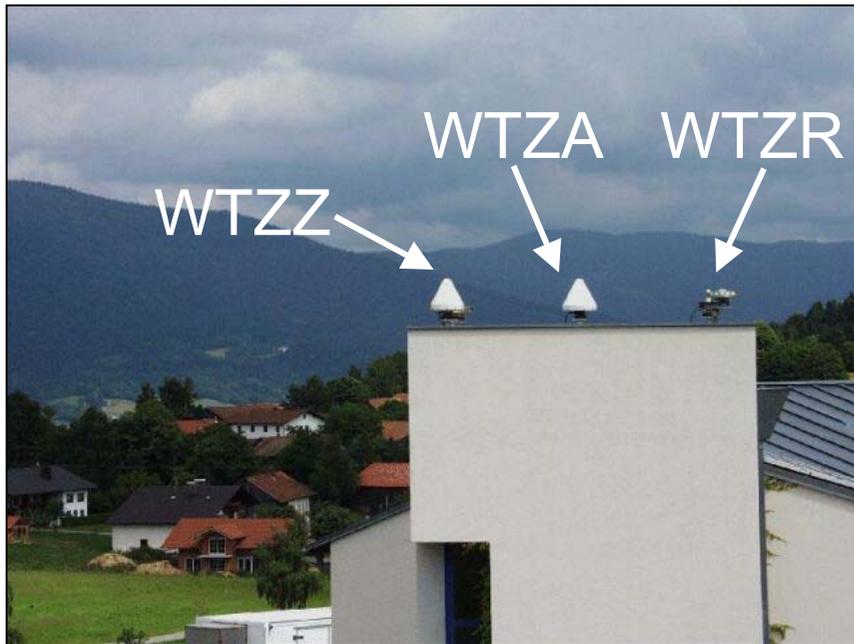
Station	North [mm]	East [mm]	Height [mm]
ARBR	2.9	2.4	7.4
HOWA	1.6	1.4	4.6
MILT	1.3	1.5	3.8
PRAC	1.5	1.1	3.6

II. Footprint Network: Station Velocities



RMS of velocities: < 0.1 mm

III. Antenna Array: Map and Description



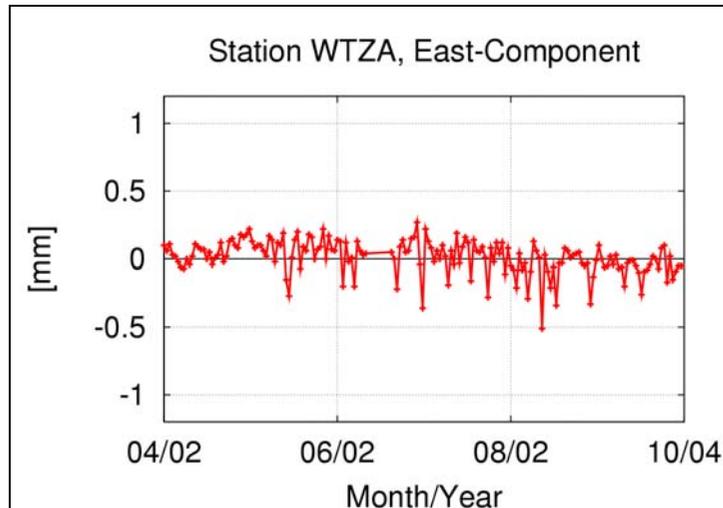
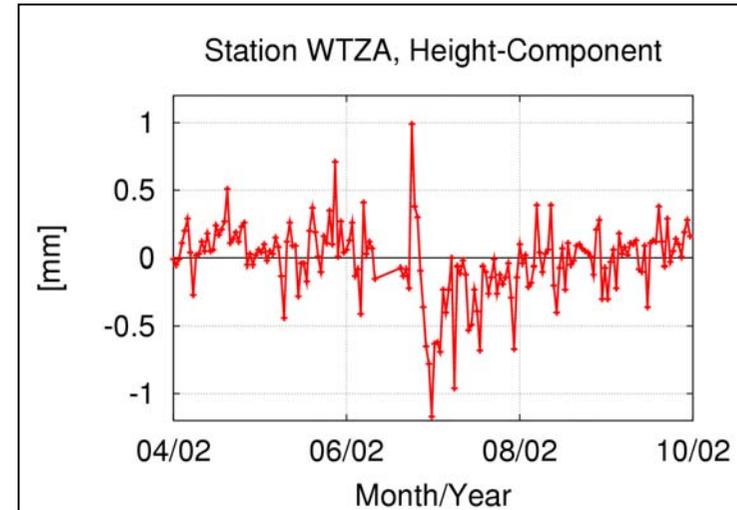
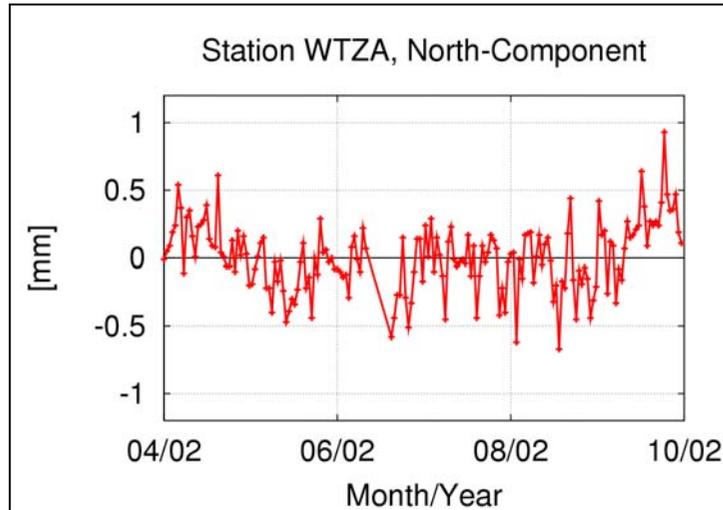
Baseline lengths: 2 - 5 m

Observation period: Nov. 1999 - Jan. 2004, ~4 years

Strategy: ambiguity-fixed L1/L2 solutions & ionosphere-free solution with troposphere (WTZR as reference)

II. Antenna Array: System Quality, L1-Solution

Example WTZA (summer 2002):

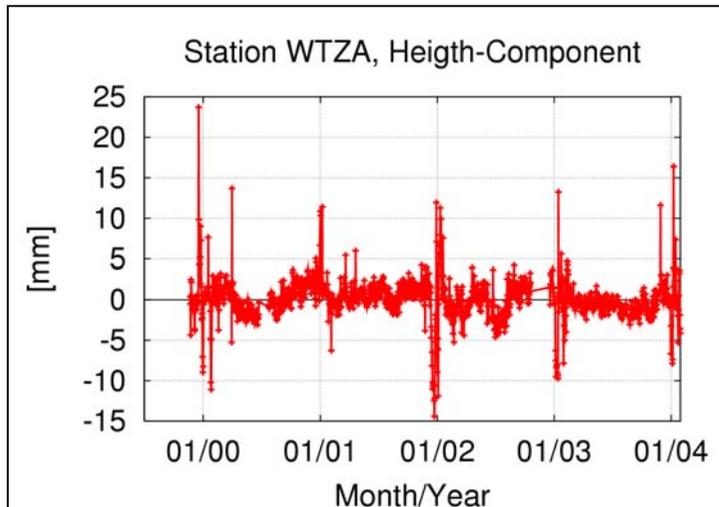
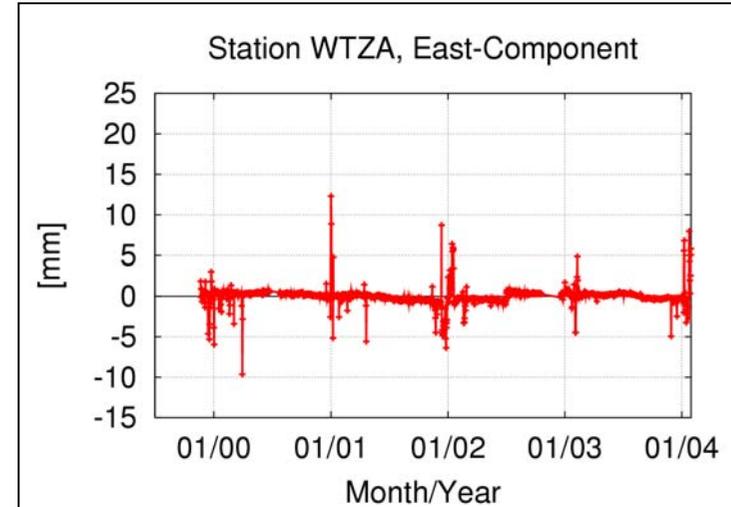
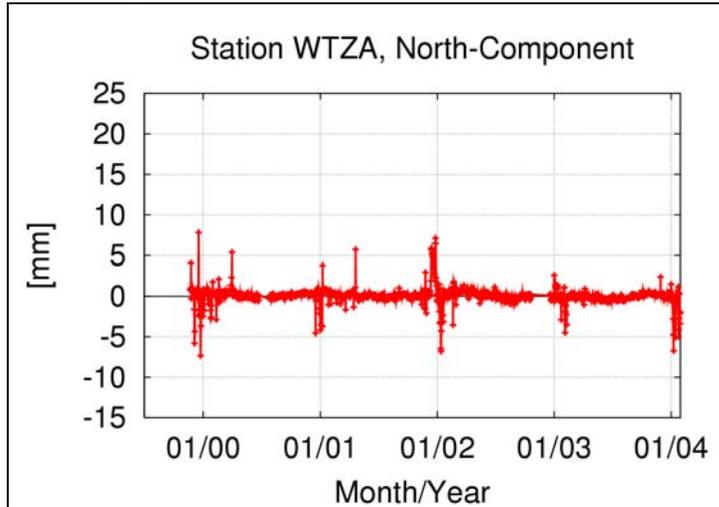


Repeatabilities of all stations:

Station	North [mm]	East [mm]	Height [mm]
WTZA	0.25	0.12	0.27
WTZJ	0.15	0.17	0.49
WTZT	0.29	0.18	0.34
WTZZ	0.24	0.09	0.28

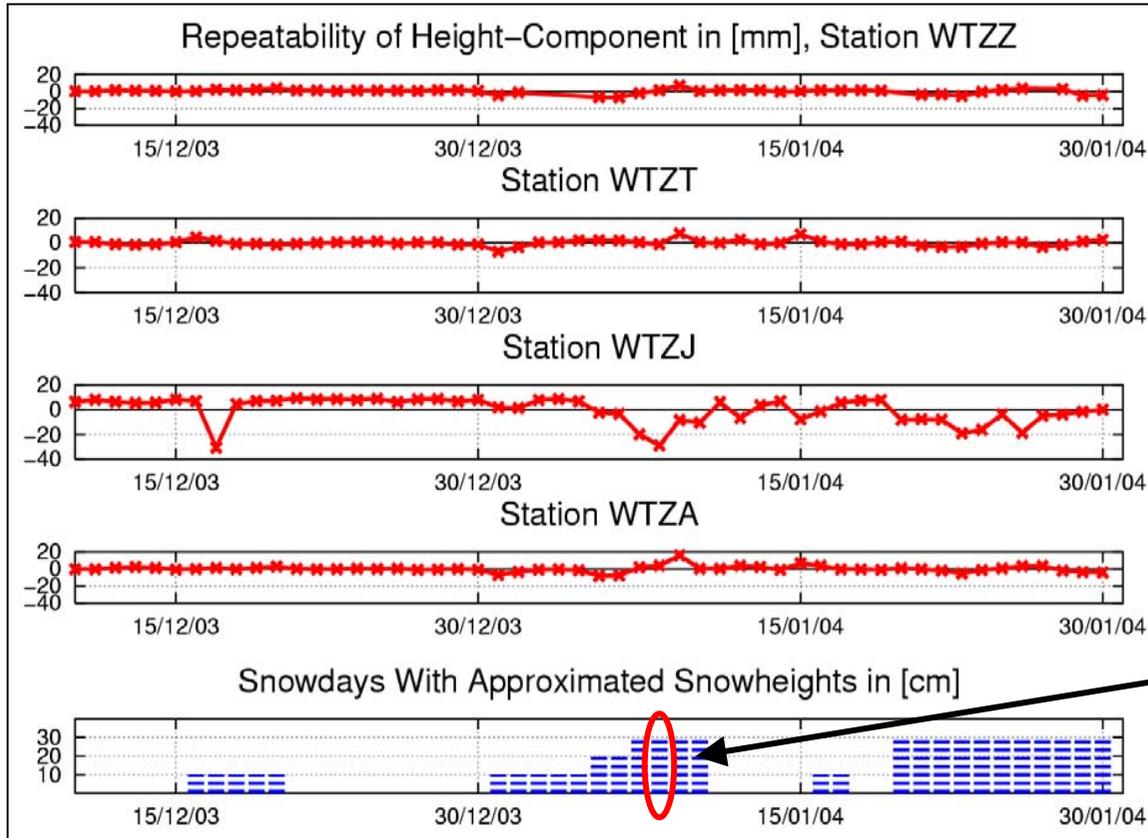
II. Antenna Array: Long-Term Repeatabilities

Example WTZA:



Ionosphere-free solution
with troposphere

III. Antenna Array: Influence of Snow Coverage



Picture from January 7th, 2004:
view to north with WTZT



Webcam to monitor

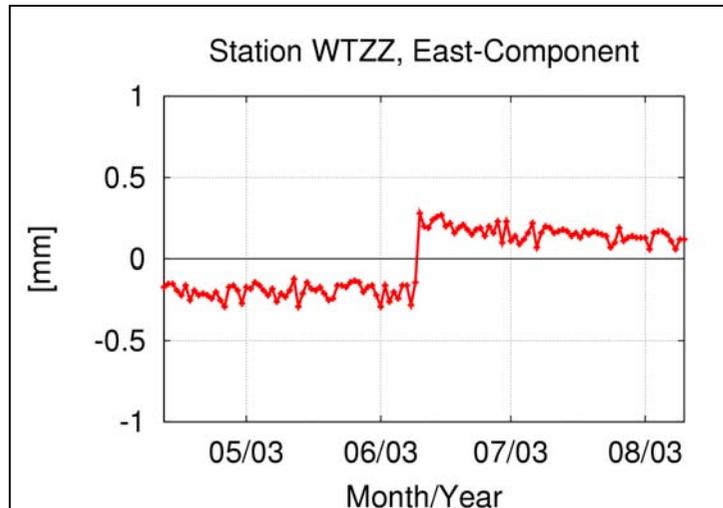
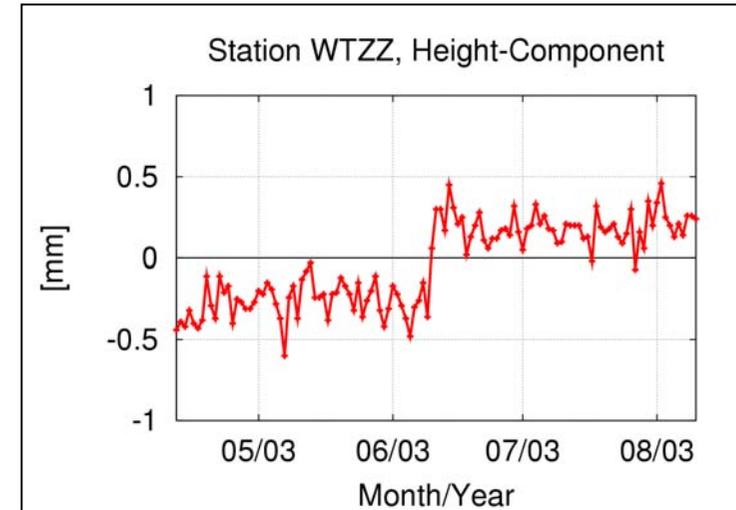
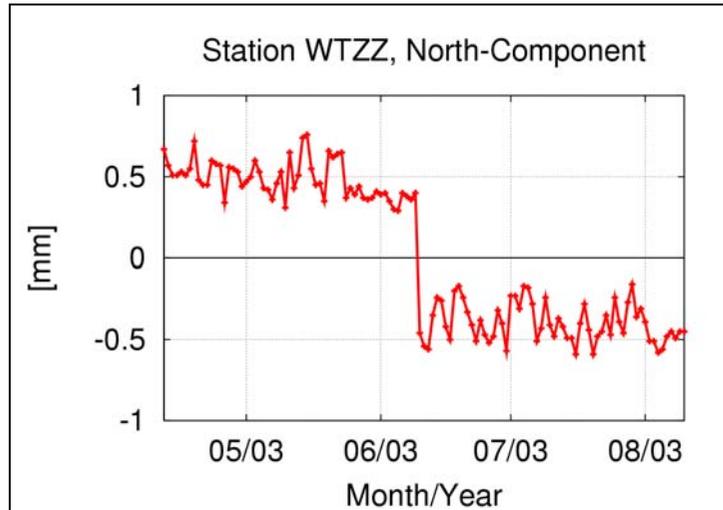
- snow days,
 - snow on the antenna
- Installed: Dec 10th 2004
2 pictures per day

Ionosphere-free solution with troposphere estimation

Main effect in height component

Antenna specific behavior of the effect !?

III. Antenna Array: Equipment Change for WTZZ, L1-Solution



RMS	Ashtech Z 18	JPS LEGACY
North	0.14 mm	0.17 mm
East	0.09 mm	0.10 mm
Height	0.12 mm	0.12 mm

< June, 10th > June, 10th

Conclusions

- **Footprint Network:**

- **Repeatability** of **1-2** mm in horizontal and **4** mm in vertical position
- No significant linear movements in the local environment
- Strong **seasonal signal** in the east-component of MILT and HOWA (movement of buildings ?)
- Well-suited to **monitor the local environment** of a fundamental site

- **Antenna Array:**

- Extremely short baselines with a repeatability of **< 1mm** in all components
- High-quality monitoring of the performance of the equipment
- **Equipment change possible** without loss of local ties between antennas
- **Snow coverage** changing height can be monitored with a **webcam**

An antenna array is recommended for every fundamental GPS site

Thank you for your attention !